Quadratics

Polynomial: $f(x) = ax^2 + bx + c$ ⟶ data fitting

vertex (standard): $f(x) = a(x-h)^2 + k$ ⟶ graphing, x-int, vertex

factored: $f(x) = a(x-R_1)(x-R_2)$ ⟶ x-int, vertex

(R_1, R_2: roots)

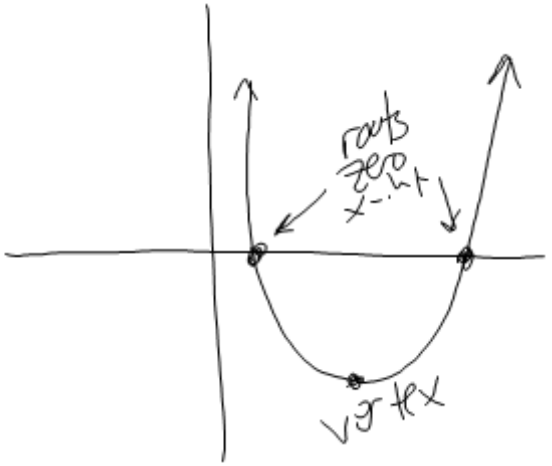
What you need to do/know

- → Factor
- → Expand (foil)
- → Quadratic formula
- → Completing the square

- → Different forms
- → Graph it
- → max/min
- → roots, i.e. x-int.

Vocab

parabola
vertex
zeros
roots
increasing/decreasing
max/min
axis of symmetry



Completing the Square

ax^2+bx+c

$x^2-2x-6=0$

$+6 \quad +6$

$x^2-2x=6$

b-term $=-2$

$\frac{1}{2}$ b term $=-1$

Square it $=1$

$x^2-2x+1=6+1$

$(x+-1)^2=7$

$(x-1)^2-7=0$

vertex $(1,-7)$

$\sqrt{(x-1)^2}=\sqrt{7}$

$x-1=\pm\sqrt{7}$

$x=1\pm\sqrt{7}$

(1) move the constant to other side

(2) $\frac{1}{2}$ b-term, square it, add to both sides

(3) Factor the left side
Simplify the right side
left-side always factors to $(x+\frac{1}{2}b)^2$

(4) Choices
Find vertex, subtract C-term over again
$(x-h)^2+k=0$
vertex (h,k)

(5) Solve for roots

Try completing the square, and find vertex and roots

① $x^2 - 12x + 5 = 0$

$x^2 - 12x = -5$

$x^2 - 12x + 36 = -5 + 36$

$(x-6)^2 = 31$

vertex $= (6, -31)$

roots $= 6 \pm \sqrt{31}$

Can only complete the square if a-term is 1

$2x^2 + 8x + 3 = 0$

Step 0

Divide everything by a-term

$x^2 + 4x + \frac{3}{2} = 0$

complete from here

Step end

multiply everything back by a-term

$(x-3)^2 = -2$ if a-term 3

$3(x-3)^2 = -6$

$\frac{-x^2}{-1} + \frac{2x}{-1} - \frac{3}{-1} = 0$

$x^2 - 2x + 3 = 0$

Complete from here

Max and Min

$y = a(x-h)^2 + k$ vertex (h, k) if $a>0$ min ∪ $a<0$ max ∩

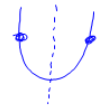
$y = a(x-R_1)(x-R_2)$

vertex x-coord is the average of the roots

$\frac{R_1+R_2}{2}$ = x-coord of vertex (h)

then plug that h into original equation to find the y-coord. (k)

Example



$y = 4(x-3)(x+5)$

$\frac{3+-5}{2} = -1$ (h) x-coord

$y = 4(-1-3)(-1+5)$ vertex $(-1, -64)$

y-coord $= -64$ (k)

$y = ax^2+bx+c$ vertex x-coord $h = \frac{-b}{2a}$

k = plug h back to original

Example

$y = 2x^2+8x+3$

vertex $\frac{-8}{2(2)} = -2 = h$

$y = 2(-2)^2+8(-2)+3$

$y = -5$

vertex $= (-2, -5)$

Sect. 2.1

#1-8, 11, 12, 13-26(3), 27-33(odd), 35-38(2)

39-42(2)

to find a-term

$y = a(x-h)^2 + k$

plug in value for h, k then the point given for x & y, solve for a